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A preliminary study on spike characters of betel vine (*Piper betle* L.)

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Abstract

Betel vine is a dioecious crop and both male and female clones are cultivated based on local preference. Sex determination in this crop is not readily possible as flowering in both the sexes is observed in specific regions of the country (Northeast and Western Ghats). Unfortunately, little is known about the sex determination system of Piperaceae and has not been studied in *P. betle* (Khadke *et al*, 2012). In Kerala, Tirur and nearby areas of Malappuram district are famous for betel vine cultivation covers an area of 183 ha (FIB, 2014). *Puthukodi*, *Chelan*, *Karinadan* and *Nadan* were the betel vine land races grown in Malappuram District. As part of a characterization study of Tirur betel vine types, profuse flowering was observed in all land races. *Chelan* was identified as male land race and all others were female cultivars. Spikes produced on *Chelan* were long, slender with short peduncle. Female cultivars produced medium lengthly spikes having medium diameter. Spikes were axillary and opposite to leaf. Sessile naked florets were compactly arranged on the inflorescence axis. A bract subtended each floret, both in male and female spikes.

Keywords: Anthesis, peduncle, male cultivar, spikes, stamens

1. Introduction

Betel vine (*Piper betle* L.) is a dioecious, evergreen creeper belonging to the family Piperaceae. It is an indigenous medicinal plant with glabrous, deep green, heart shaped leaves as economically important part.

Betel leaves have many medicinal properties and are used in Indian system of medicine to cure indigestion, stomach ache, diarrhoea, flatulence and to heal wounds, scales, burns, swelling *etc.* The leaves are credited with wound healing property. In *Susruta Samhita*, it is mentioned as aromatic, sharp, hot, acrid and beneficial as laxative and appetizer.

In betel vine both male and female clones are cultivated based on local preference. Sex determination in this is not readily possible as flowering in both the sexes is observed in the specific regions of the country (Northeast and Western Ghats). Gender based differences were reported in *P. betle* with respect to many traits such as leaf shape, amount of chlorophyll, essential oil composition, total phenol and thiocyanate content. Unfortunately, little is known about the sex determination system of Piperaceae and has not been studied in *P. betle*. Classifying the germplasm and collection of new germplasm needs knowledge of the sex of the plant, which is time consuming process (Khadke *et al*, 2012) [5].

In India, it is cultivated in an approximate area of 45,000 ha as cash crop. In Kerala, Tirur and nearby areas of Malappuram district are famous for betel vine cultivation with an area of 183 ha (FIB, 2014) [3].

During the study of *Tirur betel vine* types, profuse flowering has been observed in all cultivars. However earlier studies shown that the flowering of betel vine under Indian climate is rare. In this circumstance, a preliminary study on flowering of betel vine is undertaken as part of characterization. It will be a source of data on flowering nature of betel vine in future years for those who are interested in floral morphology and breeding aspects.

Materials & Methods

Puthukodi, *Chelan*, *Karinadan* and *Nadan* were the betel vine land races grown in Malappuram District. Planting material of *Muvattupuzha Local* was collected from Asamanoor, Ernakulum district. *Puthukodi*, *Chelan* and *Karinadan* along with *Nadan* (Local check variety) and *Muvattupuzha Local* type from Asamanoor as check variety were raised in farmer's field in Malappuram district during 2013 – 14.

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The betel vine genotypes were characterized based on the following floral characters. Characters of spikes were recorded as and when spikes appeared in each cultivar. Spike length was measured from the tip of the spike to the base of the spike in centimeters and grouped as short (< 1 cm), medium (1-3 cm) and long (> 3 cm). Spike diameter was calculated and expressed in centimeters. The observations were grouped as slender (<0.5 cm), medium (0.5 - 0.7 cm) and thick (>0.7 cm). Spike peduncle length was measured in centimeters from the base of the peduncle to the base of the spike. The observations were grouped as short (<3.5 cm), medium (3.5 – 4.5cm) and long (> 4.5 cm). Observations were recorded from 10 randomly selected vines of each cultivar and the mean was worked out.

Results & Discussion

Floral Morphology

During the study period cultivars showed profuse flowering (Fig I). This was contradictory to the observation (CSIR, 1969) that flowering and fruit setting was rare in Indian climate. Initiation of spike was noticed from five months after planting. Male and female plants were identified at the stage of spike formation. Spikes appeared first in *Chelan* followed by other cultivars. *Chelan* was the only male cultivar identified in the study. All other cultivars viz., *Puthukodi*, *Karinadan*, *Nadan* and *Muvattupuzha Local* were identified as female (Fig. 2). This is contradictory to report that usually male plants are cultivated throughout India to harvest green leaves (Lakshmi and Naidu, 2010) [4].

In all cultivars, axillary spikes opposite to the leaf were noticed. Individual florets were many in number, sessile, naked and compactly arranged on the inflorescence axis. A bract subtended each floret, both in male and female spikes.

The matured male florets were yellow in color with the two black stamens (Fig. III) protruded at the stage of anthesis. All other floret parts were modified into a bract and embedded on the rachis. Immature female spikes were green in color. Matured female spikes were identified by the presence of whitish, sessile stigmatic lobes (Fig. IV). On ageing the

stigmatic lobes became black. Number of stigmatic lobes in cultivars varied from six to nine. The stigmatic lobes became black coloured towards the end of spike maturation.

Spike Length

Significant variation was observed with respect to spike length among different cultivars. Significantly long spikes were recorded in *Chelan* (5.97 cm). Spikes with medium length were produced by *Muvattupuzha Local* (2.68 cm), *Puthukodi* (2.60 cm), *Karinadan* (2.52 cm) and *Nadan* (2.40 cm). Among the cultivars, *Nadan* showed significantly low value for spike length. Spike was with medium length in all female cultivars. According to Chaveerach *et al.* (2006) [1], 3.0 to 12.0 cm and 2.5 to 4.0 cm lengthy male and female spikes respectively were produced in betel vine.

Spike Diameter

The data showed that marked difference existed among the cultivars of betel vine for spike diameter. The female cultivar, *Puthukodi* recorded the significantly high diameter of 0.60 cm (Table I) followed by *Karinadan* (0.55 cm), *Muvattupuzha Local* and *Nadan* (0.50 cm each). The male cultivar, *Chelan* had slender spikes with significantly low spike diameter of 0.40 cm. In this study, male cultivar produced long slender spikes and female cultivars produced spikes with medium length and diameter (Fig. V).

Spike Peduncle Length

There was significant difference among cultivars for spike peduncle length. Peduncle having medium length was recorded in *Karinadan* (3.65 cm) and *Puthukodi* (3.77 cm). *Chelan*, *Muvattupuzha Local* and *Nadan* recorded short peduncles of 3.07, 3.25 and 3.42 cm respectively. Generally spike peduncle length was lower in male cultivar when compared to female cultivars. Chaveerach *et al.* (2006) [1] reported that peduncle length of betel vine varied from 2 - 3 cm. Indirect relationship was seen in between spike peduncle length and spike length. *Chelan* produced longer spikes with shorter peduncles.

Table I: Spike characters of different betel vine cultivars of Malappuram district during 2013 - 14

Cultivars	Characters	Spike length (cm)		Spike diameter (cm)		Spike peduncle length (cm)	
Puthukodi		2.60 ^b	medium	0.60 ^a	medium	3.77 ^a	medium
Chelan		5.97 ^a	long	0.40 ^d	slender	3.07 ^c	short
Karinadan		2.52 ^b	medium	0.55 ^b	medium	3.65 ^a	medium
Nadan		2.40 ^c	medium	0.50 ^c	medium	3.42 ^b	short
Muvattupuzha local		2.68 ^b	medium	0.50 ^c	medium	3.25 ^b	short



Fig I: Spikes with numerous florets in *Karinadan*, *Nadan* and *Puthukodi* land races

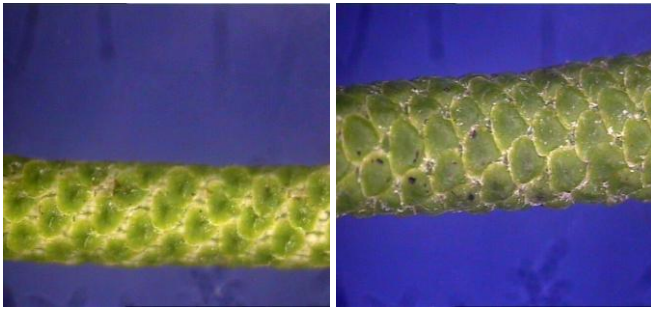


Fig II: Male spike (*Chelan*) and female spike (*Karinadan*) of betel vine before anthesis

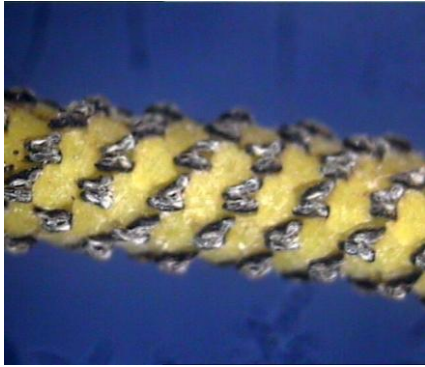


Fig III. Male florets with two black stamens in *Chelan* land race

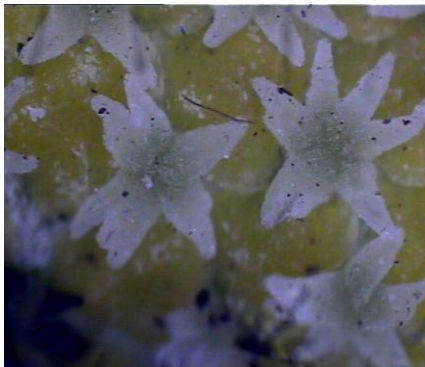


Fig IV: Whitish sessile stigmatic lobes of *Nadan* land race



Fig V: Spikes of *Chelan* and *Puthukodi* land races

Conclusion

Profuse flowering was observed in all land races during the study period. *Chelan* was identified as male land race and all others were female cultivars. Spikes produced on *Chelan* were long, slender with short peduncle. Female cultivars produced medium lengthly spikes having medium diameter. Spikes were axillary and opposite to leaf. Sessile naked florets were compactly arranged on the inflorescence axis. A bract subtended each floret, both in male and female spikes. Female spike was very distinguishable with the presence of 6 - 9 white coloured sessile stigmatic lobes on each floret. Male spikes were yellow in color and at the stage of anthesis, two black stamens protruded from each florets.

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